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Where there is smoke: Introduction to the virtual special issue of health impacts of wildland fire smoke exposure - Selected papers from the 2nd International Smoke Symposium

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1. Background and motivation

The Second International Smoke Symposium (ISS2: http://www.iawfonline.org/2016SmokeSymposium/), held in November 2016 in Long Beach, California, USA, was sponsored by the International Association of Wildland Fire and had participation from atmospheric scientists, ecologists, mathematicians, computer scientists, climatologists, social scientists, health professionals, smoke responders, wildland fire-fighters, business owners, national, tribal, state, and local government officials from North America, Europe, and Australia, and others to discuss the complex issues of wildland fire smoke and identify knowledge gaps and opportunities for innovation and development. This Virtual Special Issue, composed of five original contributions invited from the over 100 oral and poster presentations at ISS2, illustrates current interdisciplinary approaches and technological advances needed to quantify, understand, and communicate the human impact of wildland prescribed fires.

2. A summary of results

The five peer-reviewed invited submissions span a broad spectrum of health and human impact research related to wildland (i.e., wildfires in forests and grassland ecosystems) and prescribed fires. The Symposium opened with a plenary which summarized current knowledge of the impact on human health from wildland fire smoke exposures. This provided symposium participants a common framework of information since disciplines represented ranged from fire responders to smoke exposure and health effects researchers. Dr. Wayne Cascio reported a summary from systematic literature reviews that document positive associations between wildfire smoke exposure or wildfire $PM_{2.5}$ and all-cause

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mortality and respiratory morbidity. He noted that literature has identified susceptible populations as people with existing respiratory disease, older adults, children and pregnant women. Increasing fire frequency affecting large areas, expansion of the wildland-urban interface, and an aging U.S. population all contribute to an increase in the at-risk population for wildfire smoke related health effects. However, recent developments in our ability to measure health effects over larger areas and for longer time periods will be useful for better definitions of at-risk and sensitive populations, and could help assess how social factors influence the relationship between wildfire smoke exposure and adverse health effects. Cascio concluded that with research and expert advice, forecasting tools can developed to be used to communicate information for action by public health officials and health care providers. This in turn can inform the public to adopt behaviors to lower exposure and protect their health.

Fann et al. completed a multi-year burden analysis of wildland fire smoke exposure on excess mortality, morbidity events, and economic value across the contiguous U.S. Based on this new framework, thousands of premature deaths and illnesses were concentrated in 2008 and 2012 in the Northwest and Southeast, with a cost ranging from tens to hundreds of billions of US$. Liu et al. found that the common practice of prescribed fires in the prairies and rangelands of Kansas increased ambient ozone (O_3) concentrations, impacting local and regional health. However, since 2011, the frequency of high O_3 days has decreased, which may be partly related to the successful implementation of the Flint Hills Smoke Management Plan (http://www.ksfire.org/). Smoke from the May 2016 mega fire near Fort McMurray and Horse River in the Athabasca Oil Sands Region, Alberta, Canada was monitored by the Wood Buffalo Environmental Association (http://www.wbea.org/). Landis et al. used this monitoring data to analyze the impact of smoke from this unusually large spring-time boreal fire on hourly and daily (24-h) $PM_{2.5}$ concentrations. The boreal wildland fire showed uniform Pm2.5 profiles across the WBEA network, indication that these fire profile can be used as fingerprints for assessing impact and risk of future wildland fires on the local and tribal communities as well as wildland fire fighters. The highest maximum hourly PM2.5 measured during the Fort McMurray wildland fire event was 6101 $\mu g/m^3$ at the Muskeg River Industrial Site, which is approximately 226 times larger than the 24-hour PM2.5 Canadian Ambient Air Quality Standards (CAAQS) for 2020 (CAAQS, 2012).

Identification of vulnerable populations and places can assist in quantification of smoke-related disease burden, which in turn can strengthen preparedness and response capabilities for public health of-ficials participating in wildfire response. Vaidyanathan et al. describe development of an online tool for population vulnerability assessment that integrates short-term predictions and smoke concentration forecasts with health-related measures of population-level vulnerability. This will allow real-time identification of populations at risk from wild-fire smoke, filling a gap needed to inform implementation of appropriate interventions for the ever growing areas affected by wildfire smoke.

Non-VSI references

Canadian Ambient Air Quality Standards (CAAQS), 2012 Canadian Ambient Air Quality Standards (CAAQS) for Fine Particulate Matter (PM2.5) and Ozone. (URL). www.ccme.ca/files/current_priorities/aqms_elements/caaqs_and_azmf.pdf, Accessed date: 19 December 2017.